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# USE OF SODIUM ARSENITE FOR CONTROLLING SUBMERGED VEGETATION IN FISHPONDS

Prepared in the Division of Game-fish and Hatcheries

## INTRODUCTION

Sodium arsenite, a substance poisonous to animals, may be used to control submerged vegetation in bodies of water in which these "weeds" have become obnoxious. Used in the quantities required for killing underwater plants, it will not injure fish and may only temporarily reduce the supply of microscopic fish food. This chemical, however, has little effect on the filamentous algae commonly known as pond scum unless these plants are floating on the surface of the water; hence other methods of eradicating such growths must be employed.

The benefits resulting from the use of sodium arsenite are twofold: heavy growths of vegetation that hinder fishing or interfere with the removal of fish from ponds which are being drained may be reduced temporarily without excessive labor costs, and the organic matter that has been bound up in the vegetation, and consequently has been unavailable for fish food, is released for the production of food for fish. Sodium arsenite will not ordinarily eliminate the vegetation permanently.

Sodium arsenite for killing weeds can be obtained in either liquid or powder form. The liquid can be purchased in 5-gallon containers under various trade names at local seed stores. This is the chemical commonly used for eliminating weeds and vegetation from pathways or rights-of-way. Since the concentration of the killing agent may be unknown in such materials, or they may include some other chemical detrimental to fish life, it is better to purchase from a dealer who will guarantee the chemical and the concentration. A list of manufacturers who can supply sodium arsenite in quantities at a known concentration is appended.

Sodium arsenite in the powder form can be obtained from the Chipman Chemical Company, Bound Brook, N. J. That firm manufactures two kinds: one guaranteed to contain 75-percent of arsenious oxide, and the other 80-percent. The chemical is easy to handle in powder

form and may be spread directly over the surface of the water or may be dissolved in water first. Information on the prices of these materials should be obtained from the dealers. The liquid and the powder will cost about the same per unit area treated.

## HOW TO FIND VOLUME OF WATER IN LAKE OR POND

To calculate the quantity of sodium arsenite required to treat a body of water, the volume of water covering the area should be accurately measured. This necessitates the determination of both surface area and average depth. The best method of making measurements of the surface area is to use a plane table and polar planimeter. With the plane table an exact drawing of the body of water can be made to scale. Polar planimeter measurements can be used to compute quickly and accurately the surface area. Other less exact methods may be used. A pocket transit with double cross hairs and a stadia rod can be utilized to determine the average length and width of the water surface. Field maps, Geological Survey topographical maps, or aerial photographs owned by the Soil Conservation Service or other similar agencies are sometimes available. The area of small ponds more or less regular in shape may be determined by measuring with a surveyor's chain or a tapeline.

To ascertain the volume of water, the surface area, found by any of the methods mentioned, should be multiplied by the average depth, determined by frequent soundings at regular intervals across the body of water. The volume of water in cubic feet is used to find the quantity of sodium arsenite needed. For example, a pond 50 feet wide at one end and 30 feet at the other and 125 feet long at one side and 135 feet at the other would average 40 feet wide by 130 feet long. By multiplying the average length by the average width the surface area is found to be 5,200 square feet. Suppose it is decided to take soundings across the pond on five cross sections equally distant from each other and at five points on each cross section equal distances apart. The readings, in inches, may be as follows:

| | | | | |
|---|---|---|---|---|
| 19 | 19 | 17 | 20 | 17 |
| 24 | 36 | 36 | 40 | 42 |
| 38 | 42 | 48 | 52 | 58 |
| 24 | 32 | 38 | 42 | 48 |
| 18 | 16 | 19 | 25 | 30 |

These 25 soundings total 800 inches; the average depth, therefore, is 32 inches, or 2.67 feet. The volume of water (found by multiplying the area, 5,200 square feet, by the average depth, 2.67 feet) will be approximately 13,884 cubic feet.

## HOW TO DETERMINE THE QUANTITY OF CHEMICAL REQUIRED

One gallon of liquid weed killer containing 4 pounds of arsenious oxide ($As_2O_3$) diluted in approximately 64,103 cubic feet of water is equivalent to one part of the oxide per million parts of water by weight.

If the dry compound is used, it will require 5 pounds of the 80-percent arsenious-oxide product, or 5.33 pounds of the 75-percent product to produce the same concentration.

To determine the number of gallons of sodium arsenite required to treat the pond, therefore, divide 13,884 by 64,103; this yields a quotient of approximately 0.216 gallons, or 1.73 pints. Hence, it would take 1.73 pints of the chemical to produce a concentration in this pond of one part per million. But to be effective in killing the submerged vegetation it would require a concentration of at least 2.5 parts per million in most cases. Therefore, 2.5 times 1.73, or 4.33 pints, would be needed to treat the pond. Undoubtedly a quantity so small would have to be diluted in order to spray it evenly over the surface of the pond.

If the dry chemical is to be used, a slightly different method of computation must be employed. Since with the 80-percent arsenious-oxide product each pound of the chemical has a concentration of 80-percent of arsenious oxide, 1.25 pounds of the chemical per million pounds of water equal one part of arsenious oxide per million pounds of water. Inasmuch as 2.5 parts per million are required for effective action, 1.25 times 2.5, or 3.125 pounds of chemical per million pounds of water are needed. As the pond contains 13,884 cubic feet of water, and each cubic foot weighs 62.4 pounds, there will be 13,884 times 62.4, or 866,361.6 pounds of water in the pond, or about 0.87 million pounds of water. The quantity of the 80-percent arsenious-oxide product required to treat the pond, therefore, will be 3.125 times 0.87, or 2.72 pounds.

Submerged vegetation may be killed by using 1 to 2.5 parts of the chemical per million parts of water. For best results, however, 2 to 2.5 parts per million are required in most waters, and in a few places a much higher concentration is necessary. All rooted plants, with certain exceptions hereinafter noted, can be killed by using the chemical in the concentrations mentioned.

## HOW TO APPLY THE SODIUM ARSENITE

Since sodium arsenite is heavy, its effectiveness is confined to the area sprayed. It is essential, therefore, that the whole surface of the section of lake or pond to be treated be sprayed if all vegetation is to be eliminated. The routine practice at the hatcheries of the Fish and Wildlife Service has been to spray the entire surface of a pond, somewhat larger quantities of the chemical being used in the deeper than in the shallower parts. The liquid weed killer may be used diluted or undiluted. Although the powder may be applied directly, tests have shown results to be more uniform over the entire pond, if the powder is first dissolved in a quantity of water and sprayed over the surface.

Because the effectiveness of the chemical can be confined to any part of a body of water, it has been the practice in regular hatchery routine, where the vegetation is excessively heavy, to spray one half

of a pond at one time and the other half a few days later. This is done as a safety measure to prevent the killing of fish by using up the entire oxygen supply through the decay of large quantities of vegetation.

The results of the use of sodium arsenite can be noted in 3 to 7 days. If the treatment has been efficacious, the water will turn brown, becoming darker as time goes on. Later the vegetation will begin to collapse in spots and sink to the bottom. Finally it falls apart, leaving a black muck and a little fibrous material on the pond bottom.

No attempt should be made to treat any but standing water. It is necessary that the vegetation be exposed to the chemical for a period of time in order to be effective. In ponds or lakes that have a flow of water through them, the flow should be shut off or diverted for about a week. Where there is a flow through a body of water, restricted sections in which there is no direct current may be treated with good results.

Emergent or shore vegetation can also be killed with sodium arsenite, but on this type of vegetation the dealer's recommendations for its use should be followed. Sodium chlorate, a nonpoisonous chemical, can also be used on emergent plant growths. Directions for its use may be obtained from the Division of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C. Sodium chlorate may be obtained from some of the manufacturers listed herein.

Sodium arsenite is ineffective on the various species of lilies. Although the floating leaves will be killed, others will replace them. Lilies have food stored in the rootstocks beneath the bottom of the pond. These rootstocks send up new leaves to replace those that are killed or lost. It is, therefore, necessary to use other methods of control for such plants.

Another type of vegetation that is unaffected by sodium arsenite is Chara, or muskgrass. It may be identified by its distinctive growth. The plants are stiff and calcareous, and the branches have sharp tips. They grow only about a foot high. An unmistakable characteristic is the pungent, musty odor that is not found in any other aquatic plant. The light green growth becomes so dense over the bottom of bodies of water having a high lime content that it may exclude all other vegetation. This plant, which is really an alga, can be effectively killed with copper sulfate in the same manner as other algae.

Additional information on the control of vegetation in fishponds can be found in Controlling Vegetation in Fish Ponds with Sodium Arsenite, by Eugene W. Surber, United States Department of Commerce, Bureau of Fisheries, Investigational Report No. 11, 39 pages, illustrated, 1932.

## PRECAUTIONS

Sodium arsenite is a caustic poison. It should never be used in waters to which livestock have access. In all probability an animal could not drink enough of the poisonous water to obtain a fatal dose; but the spraying process leaves a deposit on vegetation around the shore, and livestock, which are attracted by the taste, would soon acquire enough of the poison from the emergent vegetation to prove fatal. Empty poison containers should never be left where children or animals can have access to them.

The operator should be careful to wash all traces of the chemical from his clothes or the exposed parts of his body. The caustic effect on the hands or other parts of the body may be very irritating and result in rather severe burns.

The use of poisons on ponds may be prohibited by law in certain States; therefore, before undertaking such treatment, the State law governing such procedure should be consulted.

## UNITS OF MEASURE

1 acre contains 43,560 square feet.
1 cubic foot contains 7.48 gallons.
1 cubic foot of water weighs approximately 62.4 pounds.
1 gallon of water weighs approximately 8.34 pounds.
1 pound of arsenious oxide per million pounds of water equals one part per million.
1 gallon contains 128 fluid ounces.

## MANUFACTURERS OF ARSENIC WEED KILLERS

Chipman Chemical Company, Inc., Bound Brook, N. J.
General Chemical Company, 40 Rector Street, New York. N. Y.
Hamilton Manufacturing Company, Rahway, N. J.
James Goode Inc., 2107 E. Susquehanna Avenue, Philadelphia, Pa.
Jefferson Chemical Works, Pine Bluff, Ark.
Los Angeles Chemical Company, Inc., 1960 Santa Fe Avenue, Los Angeles, Calif.
Reade Manufacturing Company, Inc., 185 Hoboken Avenue, Jersey City, N. J.
U. S. Smelting, Refining, & Mining Company, 75 Federal Street, Boston, Mass.



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